Changing Climate Change Beliefs Through Source Matching

Undergraduate Thesis

Presented in Partial Fulfillment of the Requirements for graduation with distinction in Psychology in the undergraduate colleges of the Ohio State University

By

Gillian Davis

Ohio State University

April 2018

Project advisor: Professor Ellen Peters, Department of Psychology

Abstract

Climate change is a controversial topic. Most scientists believe climate change is occurring, but a large segment of the population disagrees, and disbelievers are more likely to be conservative. As such, researchers have examined many ways to increase belief in human caused climate change, and there has been some disagreement regarding the best way to do so. The purpose of this study is to examine how message source characteristics, recipient political ideology, and recipient political and scientific knowledge interact to predict reception of persuasive messages about climate change, and perhaps resolve some disagreement in the literature. Participants were first asked about their political affiliation, were then asked science and political questions to assess knowledge, and about their political affiliation. They were also asked questions regarding their belief in climate change, and their belief that it is human caused. They were randomly assigned to see a message from a source who matched their political ideology (a source match) or one that did not (a mismatch); messages included photos, bios, and a quote about climate change. We hypothesized that we would find source matching effects, such that conservative participants would be more persuaded by military, business, and religious sources, and that liberal participants would be more persuaded by scientists and celebrities. We also expected that effects of source expertise and source match would be greatest for high-knowledge conservative participants, who would be especially skeptical of messages about climate change. However, our messages did not seem to influence participants' climate change worry at all. More specifically, we expected that messages from conservative sources with high perceived expertise would have the greatest positive impact on climate-change belief for high knowledge participants. Instead, we found that participant characteristics (i.e., political ideology and political/scientific knowledge) interacted to predict climate change worry and

environmentally-friendly behavioral intentions, such that liberals were more worried and had greater behavioral intentions than conservatives, and this effect was stronger when knowledge was high.

Introduction

Climate change is a heavily debated, highly politicized topic on which many Americans disagree. Human-caused climate change is occurring; it is important that people believe it is happening and is human-caused, and it is more important that they are willing to do something about it (Leiserowitz, 2016). With recent events, such as the drought and fires in California, and changing environmental policies, the controversial topic of climate change, and what to do about it, has become increasingly important.

Although the percentages of Americans who believe climate change is occurring, who believe that it is human caused, and who trust climate scientists has increased over time, there is still a significant proportion of people that do not believe this or trust climate scientists. According to studies conducted at Yale, 25% of Americans do not trust climate scientists, only a little over half of Americans find climate change worrisome, 46% do not believe that it is human caused, and 30% do not believe that climate change is happening at all (Leiserowitz, 2012).

Many studies (e.g., Bolsen & Druckman, 2016; Kahan, 2013; van der Linden, Leiserowitz, Feinberg & Maibach, 2015) have been conducted to find the best way to communicate about climate change in order to convince people that it is occurring and to take action to reduce it. Research has indicated that simple, numeric statements (eg. "97% of climate scientists have concluded that human-caused change is happening") are one effective means of communicating climate change information (Myers, Maibach, Peters, & Leiserowitz, 2015; van der Linden, Leiserowitz, Feinberg & Maibach, 2014). In addition, telling people that there is scientific consensus on climate change increases belief in the consensus on climate change. For example, participants presented with the statement "97% of climate scientists have concluded

that climate change is happening," show increased estimates of the consensus (van der Linden, Leiserowitz, Feinberg & Maibach, 2015). In addition, presenting people with information that is easy to understand and process is effective in terms in increasing the estimate of human-caused climate change (van der Linden, Leiserowitz, Feinberg & Maibach, 2015).

Other research suggests that opinionated leaders may be effective for communicating science. In particular, people may be more inclined to accept scientific information from people who match their political groups, especially from an opinionated leader (Nisbet & Kotcher, 2009). Research conducted on the effects of sources of persuasive messages supports the idea that group leaders may be particularly effective sources. First, source characteristics are very important to impacting attitudes (Ohanian, 1990). Specifically, three dimensions: attractiveness (i.e., how physically attractive the source is, or how much they are liked by the recipient), trustworthiness (i.e., how sincere or concerned with the recipient the source seems), and expertise (i.e., how much knowledge and experience the source has about the topic), affect how credible a source is to participants, which in turn determines how much they are persuaded by that source (Ohanian, 1990).

People are especially likely to be attracted to, and more influenced by, people who have similar attitudes to them (e.g., Hendrick & Page, 1970), or who share an ingroup identity, like belonging to the same university (e.g., Mackie, Worth, & Asuncion, 1990; for review see Fleming & Petty, 2000). In the case of political in-groups, sources from the same political party will have shared attitudes and a shared ingroup identity. Furthermore, people may be especially inclined to trust climate change information if it comes from a source that they consider trustworthy and that is high in expertise, and they may be more inclined to think an in-group member is trustworthy and expert (Ohanian, 1990).

Other research has studied which sources political parties tend to find more trustworthy. Studies by Kahan et al. conducted a study in which they presented participants with information regarding the controversial HPV vaccine (Kahan et al., 2010). Participants were presented with the information from a fake source who was either "culturally identifiable" or not, meaning if the source matched their in-group or did not (Kahan et al., 2010). The participants were presented with a photograph of the source, and a list of books that the source wrote. The photographs and books either matched a more "conservative" ideology or a "liberal" ideology, as perceived by participants. They found that the level of polarizing that occurred was very sensitive to whether or not the identity of the source matched the identity of the participant (Kahan et al, 2010).

In addition, people are motivated to reason in ways that allow them to fit within their in-group (Bolsen & Druckman, 2016), and some research suggests people are more likely to process information more from ingroup sources than from outgroup sources (see Flemming & Petty, 2000). Indeed, the role of ingroup identity may be particularly important, as is seen in the theory of referent emotional influence (e.g., Turner, 1991). This theory states that people's confidence in their own opinions depends on whether their ingroup shares the same views. If their views do not fit with those of their ingroup, people will often adjust their views accordingly to better align with their group (e.g., as a topic becomes politicized, people may change their beliefs to align with their party).

In the case of climate change, even when shown the consensus, people may dismiss the information if it does not fit their political ideology, and instead reject scientists as outgroup members. Consistent with this possibility, Democrats are more likely to trust information from climate scientists, who tend to be liberal, than Republicans are (Hamilton, 2014). Of course, both liberals' and conservatives' desire to fit within their political groups can motivate biased

reasoning (Bolsen & Druckman, 2016), but current conservative thinking is critical of climate change. However, based on prior research (e.g., Nisbett & Kotcher, 1999), a message from a Republican or someone who fits in the Republican group may cause change in climate change beliefs more than stereotypically liberal scientists do. Taken together, research on persuasive sources in general and climate change belief in particular support the hypothesis that source match can affect trust and be particularly important for influencing climate change beliefs.

Hypothesis 1a (H1a): Sources will be trusted more or less depending on participant's party identification (Pilot study)

Hypothesis H1b (H1b): Sources that match a participant's party identification will be more persuasive (Main study)

However, researchers have yet to study which methods of communication, along with source matching, most increase belief in climate change across political ideology. In fact, there is disagreement in the literature regarding the best way to communicate scientific information, particularly climate change information, to members of different political parties.

Some researchers (van der Linden, Leiserowitz, Feinberg & Maibach, 2015) believe that presenting participants with scientific information will increase their belief in climate change. In their gateway belief model, Van der Linden and colleagues' (2015) posit that if people are presented with expert consensus, they are likely to change their beliefs, and that these beliefs serve as a gateway to other outcomes: they may be more inclined to support a certain cause, develop a favorable opinion, or change their behavior. In this case, if people are informed of the scientific consensus around climate change (e.g., "97% of climate scientists have concluded that climate change is happening"), people should change their estimates of how many scientists believe in it. Then, people should change their beliefs in human caused climate change, worry

more about the environment, and increase support for action to reduce climate change. Van der Linden and colleagues (2014) tested this model using climate change beliefs. They presented participants information about the scientific consensus on climate change in various formats (i.e., pie charts, metaphors, or simply stating it). They found that both pie charts and simple statements were effective in increasing consensus beliefs from pretest to posttest.

Other researchers (Kahan, 2015) have found that changing beliefs may not be as simple as presenting a scientific consensus pie chart. Instead, due to motivated reasoning, some people may resist attempts to change their beliefs or reject them altogether. Motivated reasoning is the tendency for people to process information in ways that support existing beliefs or desired conclusions (Kunda, 1990). As Kunda (1990) reviews, people tend to search for information that allows them to justify their existing beliefs and avoid cognitive dissonance (i.e., discomfort experienced when information does not match previous beliefs); as a result, they tend to be biased. They also tend to search for or uncritically accept information that will support what they want to believe in. In the case of climate change, conservatives unconsciously or consciously look for information that denies climate change is human caused, and may mistrust scientists or more carefully scrutinize evidence of anthropogenic climate change. And liberals may uncritically accept that same evidence because it supports their beliefs. Indeed, despite scientific consensus on climate change, the discrepancy between liberals' and conservatives' climate change beliefs and concern perseveres (Funk & Kennedy, 2016).

Motivated reasoning is more likely when people engage in cognitive reflection (i.e., thinking and reasoning about something; Kahan, 2013) and when people have more relevant knowledge. Research has shown that, due to motivated reasoning, people tend to unconsciously search for information that allows them to stay with their in-group (Kahan, 2015). One study

looked at politically motivated reasoning regarding the scientific consensus on climate change (Kahan, Jenkins-Smith & Braman, 2011). In this study, participants were shown photos and CVs of well-regarded scientists. The participants were asked to rank to what degree they thought this person was an expert in climate change. How the participants rated the expertise of the source was highly correlated with whether or not the position of the scientist matched their own views. Therefore, if presented science is inconsistent with people's beliefs and the beliefs of their political party, they may be less inclined to trust it and to be persuaded by it (Kahan, 2015). Consistent with this hypothesis, Bolsen and Druckman (2016) asked participants to rate the extent to which they believed climate change was human caused versus a result of Earth's natural changes. They then presented some of the participants with information on the scientific consensus. They also measured group identity and knowledge of the participants, and support for three environmentally-friendly policies. The findings among low knowledge participants were consistent with the gateway belief model instead (van der Linden, Leiserowitz, Feinberg & Maibach, 2015): Specifically, low knowledge people of either party were the most likely to be persuaded by the consensus message. However, they found that partisan identity mattered for those with high knowledge. There was a divide between high- knowledge Democrats and high-knowledge Republicans. Specifically, high- knowledge Democrats already believed in climate change and thus did not change much, they were still influenced by the consensus message. However, and critically, high-knowledge Republicans rejected consensus information and even showed a nonsignificant trend towards believing in climate change *less* after receiving consensus information, which suggests that they were counter-arguing the message and engaging in motivated processing. This finding that high-knowledge Republicans were more likely to engage in motivated reasoning (in the case of climate change) is inconsistent with van der Linden,

Leiserowitz, Feinberg and Maibach's (2015) gateway belief model, and suggests that it may be harder to change strongly held beliefs than previously hypothesized at least among people with high knowledge.

As mentioned above, one way of reducing the motivation to counter-argue the message among highly knowledgeable Republicans could be to present climate change information from a source that Republicans will agree with and allows them to simultaneously believe in climate change and feel identified with their political in group. Bolson's (2016) results suggest that source may not matter much (or at least not differentially) for low knowledge participants of either party (because they were already influenced by consensus information and did not counter argue in the first place) or for high knowledge Democrats who already strongly believe in anthropogenic climate change.

Hypothesis 2 (H2): Knowledge and political ideology will interact such that high knowledge Republicans will show the greatest effect of a matching message source. (Main study)

To test these hypotheses, we presented participants multiple sources and quotes in a pilot study. This allowed us to determine how trustworthy and knowledgeable Republican and Democrat participants found the different sources and to select sources for the primary study. In the main study, we randomly presented participants with a climate change message from a source that either matched or mismatched their political ideology and was high or low in expertise based on the pilot study findings. Following the climate change message, we asked them about their belief in climate change and their willingness to take action.

Pilot study

We manipulated source information in a pretest/posttest design in order to understand how political affiliation and knowledge might influence climate change persuasion and to select

materials for the main study. Our goal was to select actual public figures whose biographies and photographs produce the largest differences in perceptions of trustworthiness between Republicans and Democrats and allowed us choose quotes that produced the smallest differences in message persuasiveness between Republicans and Democrats (thus holding belief in message content constant). We also wanted to select one high perceived expertise and one low perceived expertise for both Republicans and Democrats. We found the mean ratings of perceived trustworthiness and expertise for each source. We then subtracted the Republican perceived trustworthiness mean from the Democrat perceived trustworthiness mean. This allowed us to select those with the biggest differences in perceived trustworthiness for each group. We then needed to select one high and one low perceived expertise source that Democrats trusted more, and that Republicans trusted more. If successful, we could be reasonably sure that any observed differences in the main study would be due to the information source and not the message.

Method

Participants and design. Participants from this study were recruited from Amazon Mechanical Turk (MTurk). Of the 224 participants invited to the study from an earlier prescreening session, 150 completed the study; 69 Democrats and 33 Republicans were used in these analyses (moderates, n=48, were excluded for simplicity during the analysis.).

Procedure

In October 2018, a larger group of Amazon MTurk participants completed a baseline questionnaire, which included questions on their demographics (political party, age sex, income, education, etc.) and climate change worry. Other materials unrelated to these were also included. The climate change worry questions were also used in the main study. In late December 2017, a subset of these participants (n=150 as indicated above) completed the pilot study. In the pilot

study, participants rated eleven quotes from eleven different sources and then they rated biographical sketches of the sources. There were 5 "conservative" sources and quotes (i.e., from sources that we believed would appeal to Republicans) and 6 "liberal" sources and quotes (i.e., from sources we believed would appeal to Democrats). The quotes and sources were presented randomly and separately, so participants did not know that the quotes came from the sources.

Materials

Quotes. The quotes chosen described the potential dangers of climate change, as well as arguments that it is occurring. The full list of quotes is included in Appendix A. When presented with the quotes, participants were asked "how persuasive do you find this statement?" and "how much does this quote make you worry about climate change?" on a scale from 1 (none at all) to 5 (a great deal). The two questions were highly correlated (r=.86) and were combined into a single measure for analysis.

Source information. The biographies included a color picture of the source and information on the source's education, accomplishments, and careers (see Appendix A). We selected 5 sources that should appeal to conservatives: military personnel, a CEO, and a religious figure and 6 sources that should appeal to liberals: climate scientists, celebrity scientists, and a celebrity actor. When presented with the sources, participants were asked to rank the perceived expertise and trustworthiness of the source on scales from 1 (none at all) to 5 (a great deal).

Results

Analysis strategy

We conducted general linear model analyses (GLM) of participants' ratings of quotes, perceived trustworthiness of sources, and perceived source expertise. Each analysis included

participant's political ideology and source as predictors. This allowed us to model the ratings as repeated measures within participants and look for differences between stimuli depending on participant political ideology, as well as to see whether or not there were political ideology differences on a particular quote or source. We were looking to find sources that showed differences in trustworthiness based on ideology. However, we also wanted sources whose quotes did not show differences in ideology, so we were mainly interested in pairwise comparisons than omnibus results.

Ratings of Quotes

Across all eleven quotes, Republicans reported less persuasiveness and worry to the quotes (M=2.60, se=.21) than Democrats (M=3.73, se=0.10, b=1.12, se=0.28, Wald χ^2=16.44, p<.001). This effect of participant ideology on the quote ratings did not depend on which quote it was (p> .73). Indeed, we found the same ideology effect for each individual quote: Democrats rated each quote higher than Republicans, by .82 to 1.33 points (on a five point scale). For average ratings of quotes for each party, see Figure 1, and for means and significance tests for each quote by party, see Table 1. Thus, we will not be able to have message persuasiveness constant across political ideology, but will try to minimize it.

Perceived Trustworthiness of Sources

Trustworthiness and expertise were examined separately. We found that the sources were trusted differently (Wald $\chi^2(10)$= 267.5, p<.001), and overall trust was not significantly higher for Democrats than Republicans (Wald $\chi^2(1)$= 3.58, p=.059). As expected, and consistent with H1a, there was an interaction between source and political party (Wald- χ^2 (10)= 71.50, p<.001), which indicated that political party had a different effect on trustworthiness depending on source, see Figure 2. We next looked to see which sources were differentially trusted by Republicans vs.

Democrats. Generally, the "conservative" sources were trusted more by Republicans than Democrats, other than Admiral Witley, who was trusted equally, and Pope Francis, who was unexpectedly trusted more by Democrats than Republicans. Similarly, the "liberal" sources were trusted more by Democrats (see Table 1 for detailed significance tests between parties).

Perceived expertise of sources

We found that the sources differed in perceived expertise (Wald $\chi^2(10)= 385.83$, $p<.001$). Perceived expertise ratings were not significantly higher for Democrats than Republicans (Wald $\chi^2(1)= 1.348$, $p=.246$). Unexpectedly, there was an interaction between source and political party (Wald- $\chi^2 (10)= 37.068$, $p<.001$), which indicated that political party had a different effect on perceived expertise depending on source (see Figure 3). Generally, scientists were rated as higher in expertise than objectively non-expert sources like the Pope and DeCaprio. However, Democrats rated Pope Francis, Stephen Hawking and Bill Nye as significantly more expert than Republicans (see Table 1).

Selection of source-quote pairs

We wanted to find two sources that Democrats trusted more (one each low and high in expertise), and two sources that Republicans trusted more (again, one each low and high in expertise). We also wanted the differences in perceived expertise to be as small as possible between Republicans and Democrats, but this was difficult because trust and expertise were correlated and there were differences in perceived expertise by party. We wanted to ensure that there was a significant difference between the perceived trustworthiness of the sources for Republicans and Democrats. Therefore, if a source was perceived as highly trustworthy by both, we could not select them. We also needed to select sources whose quotes were equally persuasive and worry inducing.

We chose Stephen Hawking as the high expertise "liberal" source because there was a significant effect of political party on trustworthiness, such that Democrats rated him higher (*M*=4.48, *se*=0.09) than Republicans (*M*=3.64, *se*=0.24), Wald $\chi^2(1)=10.63$, *p*=.001, and he was perceived as high in expertise (*M*=4.23, *se*=.12); significantly higher in expertise than all other sources except for Thompson and Tyson, as indicated by pairwise comparisons (significant differences ranged from .29 to 1.65). The choice is imperfect, however, as Democrats did rate him as significantly more expert (*M*=4.49, *se*=.10) than Republicans (*M*=3.97, *se*=.20), Wald $\chi^2(1)=5.49$, *p*=.02.

Interestingly, although Pope Francis was intended to be a "conservative" source, he was significantly more trusted by Democrats (*M*=3.91, *se*=.143) than Republicans (*M*=2.94, *se*=.267), Wald $\chi^2= 10.306$, *p*=.001. Both Republicans (*M*=2.30, *se*=.225) and Democrats (*M*=2.86, *se*=.145) perceived him as low in expertise, although Democrats rated him as higher in expertise than Republicans did, Wald=4.256, *p*=.039.

We also had to take into account quote ratings in order to select the best quote/source pairs to choose for our main study. Although there were other "liberal" sources trusted more by Democrats than Republicans, Pope Francis' and Stephen Hawking's quotes were not significantly different from each other (mean difference= .12, p=.31).

We chose Dean VanderLey as the high expertise "conservative" source because there was a marginal effect of political party such that Republicans trusted him more (*M*= 3.94, *se*=.191) than Democrats (*M*= 3.49, *se*=.126), Wald $\chi^2= 3.085$, *p*=.051. Both Democrats (*M*=3.48, *se*=.108) and Republicans (*M*=3.85, *se*=.172) ranked VanderLey as high in expertise, and there was not a significant difference between the parties, Wald $\chi^2=3.326$, *p*=.068. Although he was ranked significantly lower in expertise than Hawking (mean difference= .57, *p*<.001), the other

military sources ranked high in expertise were not differentially trusted by Republican vs. Democratic participants.

Ben Van Buerden (the CEO of Shell) was chosen as the low expertise "conservative" source because Republicans trusted him significantly more (M=2.61, se= .21) than Democrats (M=2.01, se=.115), Wald χ^2=6.119, p=.013. Both Democrats (M=2.83, se=.123) and Republicans (M=3.15, se=.215) gave him similarly low ratings of expertise, Wald χ^2=1.729, p=.189). In addition, Buerden's quote and Vanderley's quote were also rated similarly to each other (mean difference= .07, p=.56) as indicated by pairwise comparisons.

Discussion

The majority of the trust rankings by participants went as expected. Sources that we predicted to match Republicans were rated higher in trustworthiness by Republicans, and sources predicted to match Democrats were rated higher in trustworthiness by Democrats. More specifically, for the most part, Republicans preferred military sources and the CEO. Democrats preferred scientists. However, there was one military source that was ranked about equal in trustworthiness between Republicans and Democrats, likely because he had his PhD. Also, surprisingly, Democrats perceived Pope Francis as significantly more trustworthy than Republicans did.

There was also a larger correlation between persuasion and trustworthiness than we were expecting (r=.69). Participant political ideology influenced perceived expertise, particularly for scientists and military personnel. Although scientists tended to be seen as more expert than other sources overall, they were seen as more expert by Democrats than Republicans, as in prior research (Funk & Kennedy, 2016). Military sources, like Vanderley and Sullivan, also were rated

differently depending on ideology: military were rated as more expert by Republicans than Democrats.

Based on the results of the GLM and mean ratings, we selected Dr. Steven Hawking as the high expertise "liberal" source, Pope Francis as the low expertise "liberal" source, Captain Dean VanderLey as the high expertise "conservative" source, and Shell CEO Ben Van Buerden as the low expertise "conservative" source. We found that Republicans consistently rated the quotes as less persuasive and worrying than Democrats did. However, we were able to find quotes that did not differ for sources who were more or less expert and more or less trusted by Republicans vs. Democrats.

It was difficult to select ideal sources, so we were only able to select one per condition. Despite the issues with selecting source-quote pairs, we did find four satisfactory pairs to present to participants in the main study.

Main Study

After selecting the source-quote pairs, we continued with the main study. We presented each participant with one of four messages (high or low expertise and "conservative" or "liberal") and measured climate change worry and environmental behavioral intentions. Our goal was to see if we could show that if a source matched a participant's political ideology, they would be more persuaded by that particular source (H1b). We also wanted to see whether source ideology and expertise mattered more for high-knowledge participants (H2).

Method

Participants and design

The main study participants were recruited from the same cohort of Amazon Mturk participants who completed the October 2018 baseline, but did not participate in the pilot study. 1,000 people participated in the original cohort. Of them, 737 people were invited to participate in the political and scientific knowledge questionnaire, and 501 completed it. Those 501 participants were also asked to participate in the final study, and 386 did complete the study. Thus for the main study, 386 participants were assigned to the cells of a 2 (source Expertise: high or low) × 2 (source party: "conservative" or "liberal") between-participants design.

Procedure

As with the pilot study, participants completed a baseline questionnaire in October 2017, which included demographics (e.g., political party, age sex, income, education, etc.) and baseline climate change worry. In late January 2018, participants who had not completed the pilot study were given eight scientific and eight political knowledge questions to determine their level of knowledge on these topics. In late February 2018, participants who completed the knowledge questions were invited to the final portion of the study. Each participant was randomly presented with of the four source-quote pairs selected in the pilot test (see Appendix C), and rated their personal level of climate change worry, and their willingness to engage in environmentally-friendly behaviors.

Measures

Political ideology. We measured political ideology in the baseline survey by asking participants to rate their political views on a scale of 1 (very liberal) to 5 (very conservative), and by asking them to select their political party affiliation (Republican, Democrat, Independent, undeclared, or other). Due to low recruitment and a higher-than-expected number of self-identified moderates in our sample, we used both political party and political orientation. Participants that reported

belonging to the Democratic party or being politically liberal were coded as liberal (1); participants reported belonging to the Republican party or being politically conservative were coded as conservative (3). Only those participants who reported being moderate and not belonging to a political party were coded as moderate (2). Three participants who said they were liberal Republicans were not included in analyses.

Science and political knowledge. In a separate survey, participants answered eight scientific and eight political knowledge questions (Appendix B). The science questions were taken from The National Science Board (2010) and included multiple choice and true or false questions. The political knowledge questions were modeled after prior research (Bolsen & Druckman 2016) and included fill in the blank and multiple choice questions. Following Bolsen and Druckman (2016), political and scientific knowledge were combined into a single knowledge index (Cronbach's α=.64).

Climate change worry. At baseline and again after the persuasive message, participants were asked three questions regarding their environmental and economic worry, two of which formed the measure of climate change worry. Specifically, participants were asked "How much do you worry about the environment?" and "How much do you worry about the economy?" and responded on scales from 1 (none at all) to 5 (a great deal). They then reported whether they found it more important to protect the environment or the economy from 1 (definitely protect the environment) to 5 (definitely protect the economy), which was reverse-scored so that higher scores indicated greater environmental worry. The question about the economy was not included in the climate change index. The two environmental questions were highly correlated (r_{Baseline} =.68, p<.001, $r_{\text{post test}}$ =.63, p<.001) and were averaged to form a climate change worry index.

Behavioral intentions. Participants were asked their willingness of completing eight environmentally-friendly behaviors (i.e., eat less beef, car pool, sign a petition, donate, ride a bike or walk, volunteer, contact local representative, or use reusable bags) on 5-point scales (1=definitely yes, 5= definitely not). These measures were highly correlated (Cronbach's α=.87) and were averaged to form an index of behavioral intentions.

Results

To test H1b (sources that match a participant's party identification will be more persuasive), we conducted a general linear model regressing post-test environmental worry on source expertise, source ideology, and participant ideology including all main effects and interactions. We found only a main effect of participant ideology: liberals had the highest worry (*M*=4.53, *se=.07*), followed by moderates (*M*=3.82, *se=.13*), and then conservatives (*M*=2.99, *se=.11*), Wald $\chi^2(2)=136.13$, $p<.001$. The main effects of the source variables, and their interactions with each other and participant ideology were not significant $p>.30$. H1b was not supported.

To test H2 (Knowledge and political ideology will interact such that high knowledge Republicans will show the greatest effect of a matching message source), we added knowledge and its interactions with political ideology to the H1b model. We then deleted nonsignificant effects one at a time, starting with the higher order interactions, and rerunning the model after each deletion. We found that ideology was related to post environmental worry, in that conservatives worried less, Wald $\chi^2(2)=13.12$, $p=.001$. Knowledge was not significantly related to post environmental worry, Wald $\chi^2(1)=1.23$, $p=.27$ We were left with an interaction of knowledge and ideology, Wald $\chi^2(2)=27.67$, $p<.001$. To examine the interaction, we coded

ideology as (1=liberal, 0=moderate, -1=conservative) and mean-centered knowledge to aid in interpretation and graphed using PROCESS. The analysis showed that the effect of ideology was stronger when knowledge was high (b=−1.05, se=.09, t(1)=−11.83, p<.001) than low (b=−.42, se=.10, t(1)=−4.41, p<.001). See Figure 4. H2 was not supported.

Even though we did not find the expected effects for environmental worry, we examined behavioral intentions in case the predicted effects of source and participant ideology emerged for behavioral intentions. The results were nearly identical to those for post-test worry, which is not surprising given the high correlation between worry and behavioral intentions (r=.68). All of the interactions for behavioral intentions involving source effects were p>.20. We also found an interaction (Wald $\chi^2(2)=16.4$, p<.001) between ideology and knowledge; PROCESS analyses revealed that the effect of ideology was stronger when knowledge was high (b=.69, se=.07, t(1)=9.90, p<.001) than low (b=.29, se=.08, t(1)=3.88, p=.001). The GLM also showed an effect of ideology such that liberals scored higher for behavioral intentions than conservatives (Wald $\chi^2(2)=6.45$, p=.04), but no effect of knowledge (Wald $\chi^2(1)=.335$, p=.55).

No significant effects on change in worry (p<.05) emerged; the baseline and post-test worry were highly correlated (r=.83). Participant ideology and knowledge strongly predicted baseline environmental worry as well, so there was no change in worry.

Discussion

Although we found sources that were differentially trusted by Republicans and Democrats and were high or low in expertise in our pilot study, the chosen messages and sources did not seem influence our outcome variables. We did not find support for either H1b or H2 in our study: our manipulation of source ideology and expertise did not influence climate change

worry or climate-related behavioral intentions. However, and consistent with previous research (e.g., Shoots-Reinhard, Petty, DeMarree, & Rucker, 2015; Drummond & Fischhhoff, 2015; Kahan et al., 2012), we found that knowledge and ideology influenced perceptions of and worry about climate change: the more participants knew about science and politics, the larger the effect of ideology on climate change worry and behavioral intentions. Specifically, high knowledge Democrats worried the most about climate change, and were more willing to behave sustainably, whereas high knowledge Republicans were less likely to believe in climate change, and less likely to behave sustainably. Similar to our findings, Drummond & Fischhoff (2015) found that more polarization occurred when the participants had more scientific knowledge. They also found that climate change was one of the topics they researched that resulted in more polarization depending on political identity (Drummond & Fisschoff, 2015). Kahan et al. (2012) also found that those who were high in scientific knowledge were not the most concerned about climate change. In fact, they found that they were the ones who polarized the most on the topic of climate change. They concluded that the lack of concern for climate change was not due to a lack of knowledge, but due to the fact that people wanted stay within their ingroup (Kahan et al., 2012).

There are a number of reasons why we did not find our predicted source effects. First, climate change attitudes are hard to change. Indeed, we found that climate change worry measurements from four months apart were extremely highly correlated. Stability is one of the hallmarks of attitude strength, and resistance to change is one of its consequences (Krosnick & Petty, 1995). Other researchers have found that climate change attitudes are difficult to change, particularly for knowledgeable people (Bolsen & Druckman 2016; Kahan, 2013).

Second, our sample was fairly highly knowledgeable; the mean score exceeded 13 points on a 16-point scale, and 14.8% of participants had perfect scores. It is possible that our sample was so high in knowledge that they were resistant to any attempts to change their attitudes. For example, highly knowledgeable conservatives may be able to call to mind many other conservative experts that dispute climate scientists. This would make our message only one of many that they can recall, reducing its impact.

It is possible that by choosing quotes about climate change rather than messages about the scientific consensus on climate change like Bolsen and Druckman (2016) and van der Linden, Leiserowitz, Feinberg, and Maibach, (2015, 2014), we changed too much from prior research. For example, van der Linden and colleagues used the statement "97% of climate scientists have concluded that climate change is happening", (see Appendix A for statements we used). However, the one quote we had that mentioned scientific consensus (i.e., Lonnie Thompson's) was not particularly highly rated overall or for Republicans, and prior research (Funk & Kennedy, 2016) has shown Republicans distrust scientists. It is also possible that our messages were too complicated, unlike the simple messages used by van der Linden et al (2014). However, given the high knowledge of our participants, that explanation seemed unlikely. In addition, enough variation in knowledge existed to find an interaction of ideology and knowledge consistent with prior research.

Finally, we expected to find source effects to be larger for conservative participants, but we had only a small number of conservatives in our sample, which could have reduced our chances of finding effects. However, we did find effects consistent with prior research (i.e., the interaction of ideology and political and political knowledge). Neveretheless, effects may have

been detected had we reached our target sample size of 600 participants or been able to recruit more conservatives.

Future research could benefit from recruiting a larger, more diverse sample (i.e., more conservatives and fewer knowledgeable people), and by using more messages. For example, if each participant had been presented with four messages rather than one, it may have helped persuade them, particularly for high expertise and politically matched sources presented to knowledgeable Republicans.

Conclusions

We found that giving people persuasive messages about climate change from high expertise sources that matches their political ideology did not change their attitudes on climate change. We found no effects of our manipulations of source expertise and political ideology match on climate change worry or environmentally friendly behavioral intentions. Instead, we found that political ideology and a combined measure of scientific and political knowledge interacted to predict these outcomes, such that ideology effects on outcomes were stronger when knowledge was high. Overall, this study has shown us that attitudes surrounding climate change are difficult to influence.

References

Bolsen, T., & Druckman, J. (2016). Partisan Group Identity and Belief in Human-Caused Climate Change. *Northwestern Institute for Policy Research*.

Drummond, C., & Fischhoff, B. (2017). Individuals with greater science literacy and education have more polarized beliefs on controversial science topics. *Proceedings of the National Academy of Sciences,* 36:114, 9587-9592.

Fleming, M. A., & Petty, R. E. (2000). Identity and persuasion: An elaboration likelihood approach. In D. J. Terry & M. A. Hogg (Eds.), Applied social research. Attitudes, behavior, and social context: The role of norms and group membership (pp. 171-199). Mahwah, NJ: Lawrence Erlbaum

Funk, C., & Kennedy, B. (2016, October 04). The politics of climate. Retrieved October 27, 2017. *Pew Research Center.* http://www.pewinternet.org/2016/10/04/the-politics-of-climate/.

Hamilton, L. C. (2015). Conservative and liberal views of science: does trust depend on the topic. *Carsey Research*, (45) 252.

Hendrick, C. & Page, H. A. (1970). Self-esteem, attitude similarity, and attraction. *Journal of Personality, 38*: 588-601.

Kahan, D.M., Braman, D., Cohen, G.L., Gastil, J., Slovic, P. (2010). Who Fears the HPV Vaccine, Who Doesn't, and Why? An Experimental Study of the Mechanisms of Cultural Cognition, *Law and Human Behavior.* 34, 501-16.

Kahan, D.M., Jenkins-Smith, H., & Braman, D. (2010). Cultural cognition of scientific

consensus, *Journal of Risk Research.* 14:2, 147-174.

Kahan, D.M., Peters, E., Wittlin, M., Slovic, P., Ouellette, L.L., Braman, D. & Mandel, G. (2012). The polarizing impact of science literacy and numeracy on perceived climate change risks. *Nature Climate Change* 2, 732-735.

Kahan, D. M. (2013). Ideology, Motivated Reasoning, and Cognitive Reflection: An Experimental Study. *Judgement and Decision Making.* (8). 407-24.

Kahan, D.M. (2015). The Politically Motivated Reasoning Paradigm. *SSRN Electric Journal.*

Krosnick, J. A., & Petty, R. E. (1995). Attitude strength: An overview. In R. E. Petty & J. A. Krosnick (Eds.), *Attitude strength: Antecedents and consequences* (pp. 1-24). Mahwah, NJ: Lawrence Erlbaum Associates.

Kunda, Z. (1990). The Case for Motivated Reasoning. *Psychological Bulletin*, 108, 480-498.

Leiserowitz, A., Maibach, E. W., & Roser-Renouf, C. (2012). Climate Change in the American Mind: Americans' Climate Change Beliefs, Attitudes, Policy Preferences, and Actions. *SSRN Electronic Journal*.

Linden, S. L., Leiserowitz, A. A., Feinberg, G. D., & Maibach, E. W. (2014). How to communicate the scientific consensus on climate change: plain facts, pie charts or metaphors? *Climatic Change, 126*(1-2), 255-262.

Linden, S. L., Leiserowitz, A. A., Feinberg, G. D., & Maibach, E. W. (2015). The scientific consensus on climate change as a gateway belief: experimental evidence. *PLoS ONE 10*(2).

Mackie, D. M., & Asuncion, A. G. (1990). On-line and memory-based modification of attitudes: Determinants of message recall-attitude change correspondence. *Journal of Personality and Social Psychology, 59*(1), 5-16.

Myers, T. A., Maibach, E., Peters, E., & Leiserowitz, A. (2015). Simple Messages Help Set the Record Straight about Scientific Agreement on Human-Caused Climate Change: The Results of Two Experiments. *Plos One, 10*(3).

Nisbet, M. C., & Kotcher, J. E. (2009). A two-step flow of influence? *Science Communication*, 30 (3), 328-354.

Ohanian, R. (1990), Construction and validation of a scale to measure celebrity endorsers' perceived expertise, *Journal of Advertising, 19* (3), 39-52.

Shoots-Reinhard, B. L., Petty, R. E., DeMarree, K. G., & Rucker, D. D. (2015). Personality certainty and politics: increasing the predictive utility of individual-difference inventories. *Political Psychology*, *36*(4), 415-430. doi: 10.1111/pops.12104

Turner, J. C. (1991). Social influence. Milton Keynes, England: Open University Press and Pacific Grove, Calif.: Brooks/Cole.

Figure captions

Figure 1: Average ratings of quotes (rated perceived persuasiveness and climate change worry) for Republicans and Democrats. Higher numbers equal greater persuasion and worry.

Figure 2: Average ratings of perceived trust of source for Republicans and Democrats. Higher numbers equal greater trust.

Figure 3: Average ratings of perceived expertise for Republicans and Democrats. Higher numbers equal greater perceived expertise.

Figure 4. Interaction of participant political ideology and knowledge (political and scientific) on post-message climate change worry. Political knowledge is ±1 standard deviation; political ideology is coded 1=liberal, 0=moderate, −1=conservative.

Figure 1. Average ratings of quotes (rated perceived persuasiveness and climate change worry) for Republicans and Democrats. Higher numbers equal greater persuasion and worry.

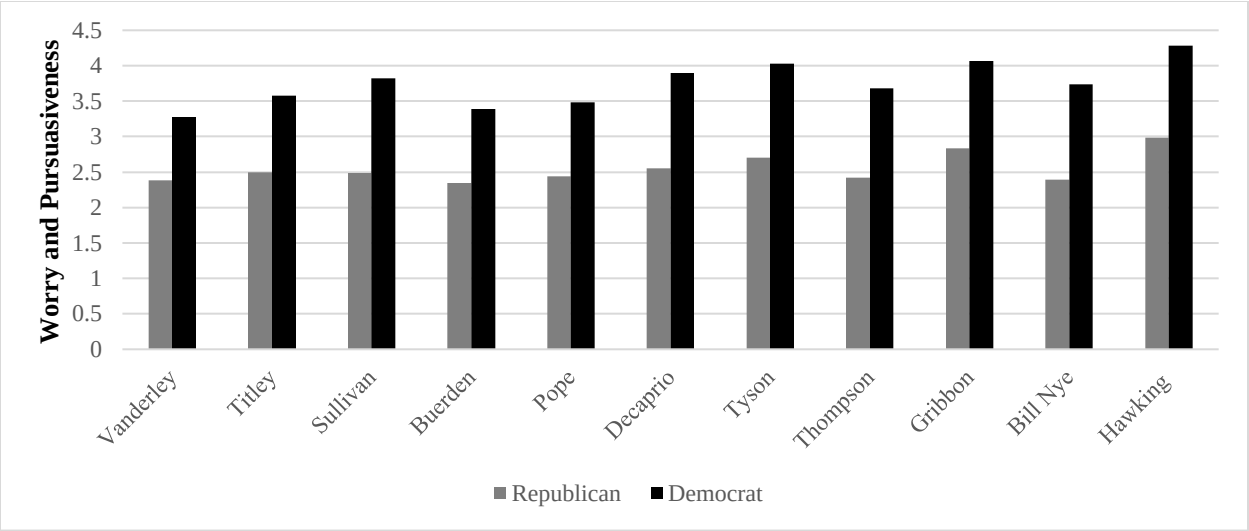

Figure 2. Average ratings of perceived trust of source for Republicans and Democrats. Higher numbers equal greater trust.

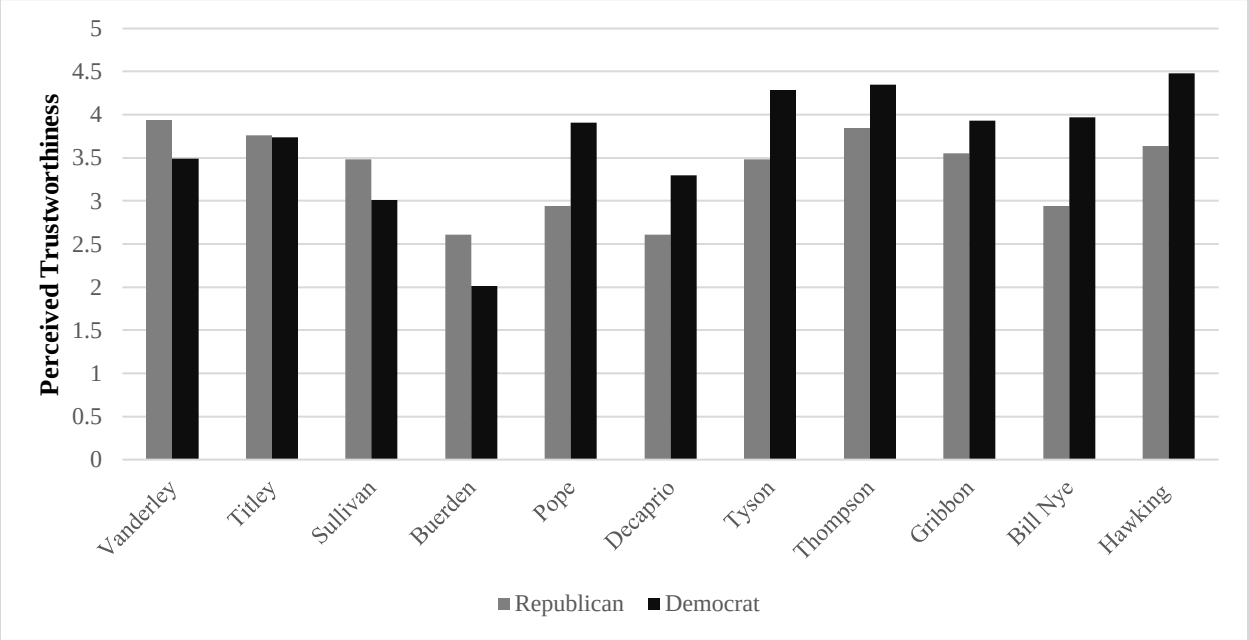

Figure 3. Average ratings of perceived expertise for Republicans and Democrats. Higher numbers equal greater perceived expertise.

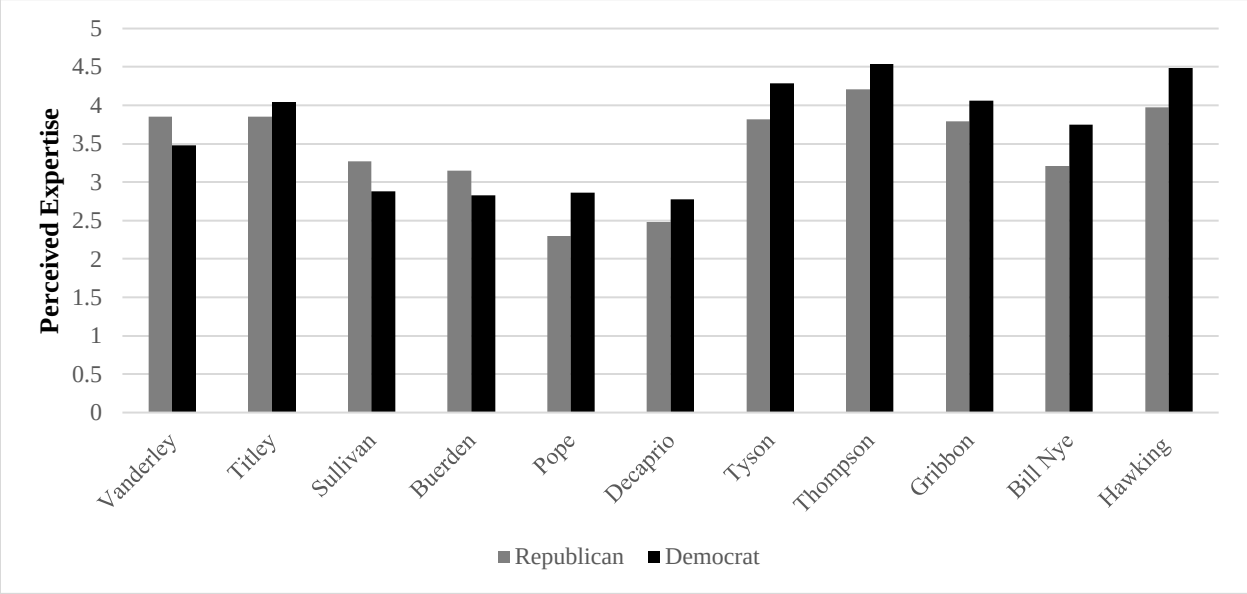

Figure 4. Interaction of participant political ideology and knowledge (political and scientific) on post-message climate change worry. Political knowledge is ±1 standard deviation; political ideology is coded 1=liberal, 0=moderate, −1=conservative.

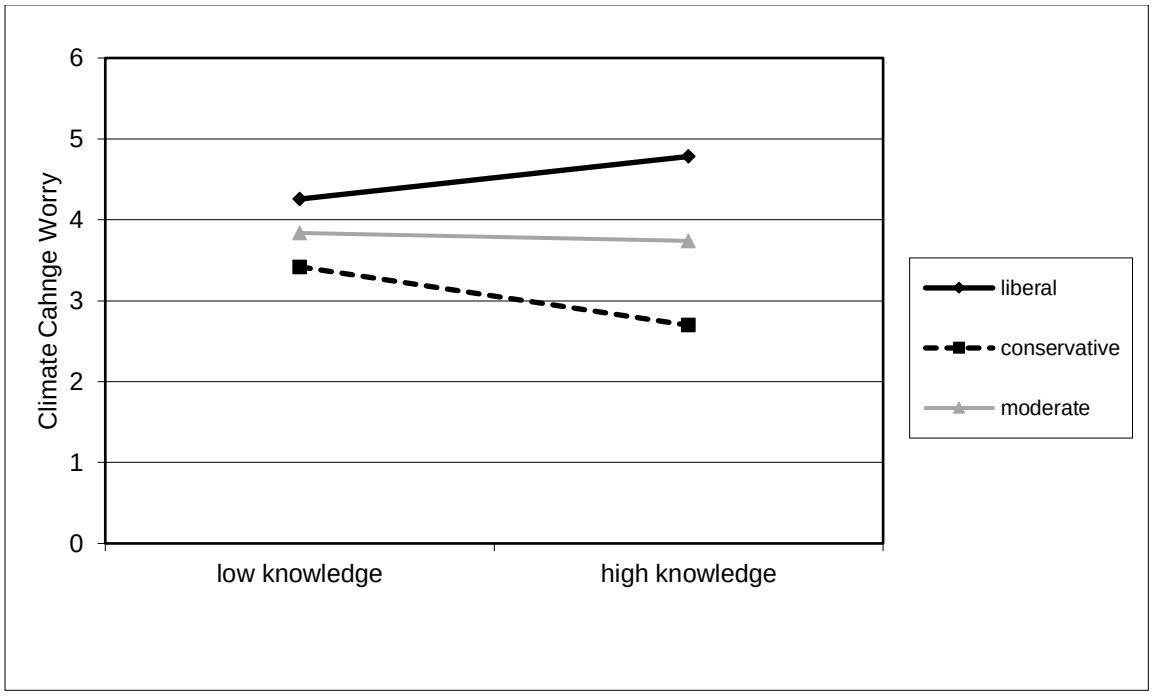

Table 1. Quote and source ratings from pilot study for all 11 pilot-tested messages. Ratings across Republicans and Democrats (i.e., overall) are presented first, followed by ratings for Republicans (R) and Democrats (D), separately. Standard errors in parentheses. Significance test is for the difference between Republicans and Democrats. Source biographies and quotes were presented to participants separately.

	average quote rating				average expertise				average trustworthiness			
	overall	R	D	Significance test	overall	R	D	Significance test	overall	R	D	significance test
Vanderley	2.92 (1.29)	2.52 (.22)	3.33 (.14)	Wald $\chi^2(1)=10.09$, $p=0.001$	3.66 (.10)	3.85 (.17)	3.48 (.11)	Wald $\chi^2(1)=3.33$, $p=0.068$	3.72 (.11)	3.94 (.19)	3.49 (.13)	Wald $\chi^2(1)=3.81$, $p=0.051$
Pope Francis	3.06 (1.43	2.58 (.24)	3.54 (.16)	Wald $\chi^2(1)=11.31$, $p=0.001$	2.58 (.13)	2.30 (.23)	2.86 (.15)	Wald $\chi^2(1)=4.26$, $p=0.039$	3.43 (.15)	2.94 (.27)	3.91 (.14)	Wald $\chi^2(1)=10.31$, $p=0.001$
Titley	2.99 (1.41)	2.42 (.24)	3.57 (.15)	Wald $\chi^2(1)=16.30$, $p<0.001$	3.95 (.10)	3.85 (.17)	4.04 (.10)	Wald $\chi^2(1)=.964$, $p=0.326$	3.75 (.11)	3.76 (.20)	3.74 (.10)	Wald $\chi^2(1)=.007$, $p=0.001$
Sullivan	3.18 (.137)	2.52 (.24)	3.84 (.13)	Wald $\chi^2(1)=23.41$ $p<0.001$	3.08 (.14)	3.27 (.23)	2.88 (.14)	Wald $\chi^2(1)=2.09$, $p=0.149$	3.25 (.11)	3.48 (.24)	3.01 (.13)	Wald $\chi^2(1)=4.47$, $p=0.03$
Buerden	2.85 (.135)	2.36 (.23)	3.33 (.14)	Wald $\chi^2(1)=12.82$, $p<0.001$	2.99 (.12)	3.15 (2.15)	2.83 (.12)	Wald $\chi^2(1)=1.73$, $p=0.189$	2.31 (.12)	2.61 (.21)	2.01 (.12)	Wald $\chi^2(1)=6.12$, $p=0.01$
DeCaprio	3.17 (.14)	2.58 (.25)	3.77 (.12)	Wald $\chi^2(1)=19.17$, $p<0.001$	2.63 (.13)	2.48 (.22)	2.78 (.13)	Wald $\chi^2(1)=1.43$, $p=0.232$	2.96 (.13)	2.61 (.22)	3.30 (.13)	Wald $\chi^2(1)=7.44$, $p=0.051$
Tyson	3.39 (.13)	2.79 (.23)	4.00 (.13)	Wald $\chi^2(1)=20.93$, $p<0.001$	4.05 (.12)	3.82 (.22)	4.29 (.11)	Wald $\chi^2(1)=3.66$, $p=0.056$	3.89 (.13)	3.48 (.23)	4.29 (.10)	Wald $\chi^2(1)=3.81$, $p=.002$
Thompson	3.02 (.13)	2.42 (.23)	3.61 (.13)	Wald $\chi^2(1)=20.10$, $p<0.001$	4.37 (.01)	4.21 (.18)	4.54 (.093)	Wald $\chi^2(1)=2.67$, $p=0.103$	4.10 (.12)	3.85 (.21)	4.35 (.09)	Wald $\chi^2(1)=3.81$, $p=0.03$
Gribbon	3.41 (.14)	2.85 (.25)	3.97 (.11)	Wald $\chi^2(1)=16.44$, $p<0.001$	3.92 (.11)	3.79 (.19)	4.06 (.11)	Wald $\chi^2(1)=1.507$, $p=0.22$	3.74 (.11)	3.55 (.20)	3.93 (.12)	Wald $\chi^2(1)=3.81$, $p=0.09$
Bill Nye	3.11 (.15)	2.45 (.25)	3.77 (.15)	Wald $\chi^2(1)=19.89$, $p<0.001$	3.48 (.12)	3.21 (.22)	3.75 (.12)	Wald $\chi^2(1)=4.78$, $p=0.029$	3.46 (.14)	2.94 (.24)	3.97 (.12)	Wald $\chi^2(1)=14.59$, $p<0.001$
Stephen Hawking	3.68 (.14)	3.09 (.26)	4.26 (.11)	Wald $\chi^2(1)=17.89$, $p<0.001$	4.23 (.11)	3.97 (.20)	4.49 (.10)	Wald $\chi^2(1)=5.494$, $p=0.019$	4.06 (.13)	3.64 (.24)	4.48 (.09)	Wald $\chi^2(1)=10.631$, $p=0.001$

Table 2. Descriptive statistics for main study measures.

	N	Minimum	Maximum	Mean	Std. Deviation	Cronbach's α
Baseline Climate Worry	379	1.00	5.50	3.82	1.28	.68
Knowledge	379	5.00	16.00	13.26	2.23	.64
Posttest Climate Worry	379	1.00	5.50	4.01	1.25	.53
Behavioral intentions	379	1.00	5.00	2.53	0.95	.87

Appendix A

Captain Dean VanderLey

Captain Dean VanderLey attended Stanford University and has his Master' in Civil and Environmental Engineering. He is currently the Commanding Officer of the NAVFAC Mid-Atlantic.

"We see the rising sea levels and flooding events...We have a responsibility to prepare for the future. We don't have the luxury of just burying our heads in the sand."

Admiral Titley

Admiral Titley attended the Naval Postgraduate School and received his Master of Science degree in Meteorology and Physical Oceanography and a Doctorate in Meteorology. Admiral Titley served more than 10 years at sea. He was the oceanographer and and navigator of the navy in 2009. In 2012 he became the acting assistant deputy chief of Naval Operations for Information Dominance. He is currently retired and is a professor at Pennsylvania State University.

"There will be a discrete event or series of events that will change the calculus. I don't know who, I don't know how violent. Climate change isn't just an environmental issue; it's a technology, water, food, energy, population issue."

Pope Francis

Pope Francis was ordained a Catholic Priest in 1969, and he became the Archbishop of Buenos Aires in 1998. In 2001, he was elected cardinal by Pope John Paul II. His papacy began in 2013.

"The monopolising of lands, deforestation, the appropriation of water, inadequate agro-toxics are some of the evils that tear man from the land of his birth. Climate change, the loss of biodiversity and deforestation are already showing their devastating effects in the great cataclysms we witness"

General Gordan Sullivan

General Sullivan retired from the Army on July 31, 1995, after more than 36 years of active service. He culminated his uniformed service as the 32nd Chief of Staff—the Army's senior general officer—and a member of the Joint Chiefs of Staff.

"People are saying they want to be perfectly convinced about climate science projections…But speaking as a soldier, we never have 100 percent certainty. If you wait until you have 100 percent certainty, something bad is going to happen on the battlefield."

Ben van Beurden

“We recognise the significance of climate change, along with the role energy plays in helping people achieve and maintain a good quality of life. A key role for society – and for Shell – is to find ways to provide much more energy with less carbon dioxide.”

Beurden has worked for Shell since 1983, after graduating with his master’s degree in chemical engineering. He has worked in the Netherlands, Malaysia, the United States, and the UK.

Leonardo Dicaprio

Although famous for his role in multiple well-known movies, he is also an environmental activist. He wrote and produced an environmental documentary called The 11th Hour. He's served on the boards of the World Wildlife Fund, the Natural Resources Defense Council and the International Fund for Animal Welfare.

“We are now experiencing what can only be called a planetary crisis — a convergence of accelerating climate change, unprecedented loss of biodiversity, and increasing human health issues caused by a toxic environment.”

Neil Degrasse Tyson

Tyson earned his BA from Harvard University and his PhD in Astrophysics from Columbia. In 2001

, he was appointed by President Bush to study the future of US Aerospace Engineering. He was appointed again in 2004 on the implementation of the United States Space Exploration Policy.

"We're dumping carbon dioxide into the atmosphere at a rate the Earth hasn't seen since the great climate catastrophes of the past, the ones that led to mass extinctions. We just can't seem to break our addiction to the kinds of fuel that will bring back a climate last seen by the dinosaurs, a climate that will drown our coastal cities and wreak havoc on the environment and our ability to feed ourselves. ...The dinosaurs never saw that asteroid coming. What's our excuse?"

Lonnie G. Thompson

Lonnie G. Thompson is a Distinguished University Professor in the School of Earth Sciences and a Senior Research Scientist in the Byrd Polar Research Center at The Ohio State University. His research has propelled the field of ice core paleoclimatology out of the Polar Regions to the highest tropical and subtropical ice fields. He has spent months studying ice cores at elevation over 5,500 meters.

"Why then are climatologists speaking out about the dangers of global warming? The answer is that virtually all of us are now convinced that global warming poses a clear and present danger to civilization"

Dr. John Gribbin

John Gribbin earned his PhD in astrophysics from the University of Cambridge in 1971. He is a British science writer and is a fellow in astronomy at the University of Sussex. He wrote In Search of Schrodinger's Cat, a famous book on quantum theory.

"By the end of the next century, the "greenhouse effect" may increase temperatures worldwide to levels that have not been reached for at least 100,000 years. And the effects on sea level and on agriculture and other human activities are likely to be so profound that we should be planning for them now"

Bill Nye

Bill Nye earned his Bachelor's degree in mechanical engineering from Cornell University. He is known for his time on an educational children's series called "Bill Nye the Science Guy".

"You can't choose to believe in gravity; if you walk off a cliff, you will be affected adversely. Climate change is not a 50-50 thing which you can choose to believe in or not. If you choose to ignore human's influence on the world's climate, we will be affected adversely."- Bill Nye

Stephen Hawking

Professor Hawking is an English theoretical physicist, cosmologist, author and Director of Research at the Centre for Theoretical Cosmology within the University of Cambridge. He was the Lucasian Professor of Mathematics at the University of Cambridge between 1979 and 2009 and has achieved commercial success with works of popular science in which he discusses his own theories and cosmology in general; his book *A Brief History of Time*.

"The danger is that global warming may become self-sustaining, if it has not done so already. The melting of the Arctic and Antarctic ice caps reduces the fraction of solar energy reflected back into space, and so increases the temperature further. Climate change may kill off the Amazon and other rain forests, and so eliminate once one of the main ways in which carbon dioxide is removed from the atmosphere. The rise in sea temperature may trigger the release of large quantities of carbon dioxide, trapped as hydrides on the ocean floor. Both these phenomena would increase the greenhouse effect, and so global warming further. We have to reverse global warming urgently, if we still can."

Appendix B

The center of the earth is very hot: **True/**False

All radioactivity is man-made: True/**False**

Lasers work by focusing sound waves: True/**False**

Electrons are smaller than atoms – **True**/False

Which is correct?**A.The Earth goes around the Sun**, B. The Sun goes around the Earth

It is the father's gene that decides whether the baby is a boy or a girl **True**/False

Antibiotics kill viruses as well as bacteria True/**False**

Which party is more conservative is the US? **Republican**/Democrat

Whose responsibility is it to declare a law unconstitutional? **Supreme Court**

Who is the current Vice President? **Michael Pence**

Who is the current speaker of the House of Representatives? **Paul Ryan**

Who is the current Chief Justice of the Supreme Court? **John Roberts**

Who was the 2016 Libertarian presidential candidate? **Gary Johnson**

Appendix C

High-expertise liberal source

Stephen Hawking

Professor Hawking is an English theoretical physicist, cosmologist, author and Director of Research at the Centre for Theoretical Cosmology within the University of Cambridge. He was the Lucasian Professor of Mathematics at the University of Cambridge between 1979 and 2009 and has achieved commercial success with works of popular science in which he discusses his own theories and cosmology in general; his book A Brief History of Time.

"The danger is that global warming may become self-sustaining, if it has not done so already. The melting of the Arctic and Antarctic ice caps reduces the fraction of solar energy reflected back into space, and so increases the temperature further. Climate change may kill off the Amazon and other rain forests, and so eliminate once one of the main ways in which carbon dioxide is removed from the atmosphere. The rise in sea temperature may trigger the release of large quantities of carbon dioxide, trapped as hydrides on the ocean floor. Both these phenomena would increase the greenhouse effect, and so global warming further. We have to reverse global warming urgently, if we still can." - Dr. Stephen Hawking

Low-expertise liberal source

Pope Francis

Pope Francis was ordained a Catholic Priest in 1969, and he became the Archbishop of Buenos Aires in 1998. In 2001, he was elected cardinal by Pope John Paul II. His papacy began in 2013.

"The monopolising of lands, deforestation, the appropriation of water, inadequate agro-toxics are some of the evils that tear man from the land of his birth. Climate change, the loss of biodiversity and deforestation are already showing their devastating effects in the great cataclysms we witness,"- Pope Francis

High-expertise conservative source

Captain Dean VanderLey

Captain Dean VanderLey attended Stanford University and has his Master' in Civil and Environmental Engineering. He is currently the Commanding Officer of the NAVFAC Mid-Atlantic.

"We see the rising sea levels and flooding events...We have a responsibility to prepare for the future. We don't have the luxury of just burying our heads in the sand." - Captain Dean VanderLey

Low-expertise conservative source

Ben van Beurden

Ben Van Beurden has worked for Shell since 1983, after graduating with his master's degree in chemical engineering. He has worked in the Netherlands, Malaysia, the United States, and the United Kingdom.

"We recognize the significance of climate change, along with the role energy plays in helping people achieve and maintain a good quality of life. A key role for society – and for Shell – is to find ways to provide much more energy with less carbon dioxide."- Ben Van Beurden